# SURVEY PROTOCOL AND AN INTERIM SPECIES CONSERVATION STRATEGY FOR *PLECOTUS TOWNSENDII* IN THE BLUE MOUNTAINS OF OREGON AND WASHINGTON

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**CHAPTER I -**

INTRODUCTION

Survey Protocol and Interim Species Conservation Strategy for Pacific western big-eared bat (Plecotus Townsendii) was developed for Forest Service biologists who are involved in field surveys and bat conservation in the Blue Mountains. Though designed for the Wallowa-Whitman, Malheur, and Umatilla National Forests, it may be useful throughout eastern Washington and Oregon, and western Idaho.

The goals of this document are to (1) summarize current knowledge of Townsends big-eared bat biology, (2) review survey methods and recommend the best methods, and (3) provide management recommendations aimed to conserve the species and its habitat. In the future, as more field data is gathered, this interim document will be updated. This document is not a final conservation strategy or a recovery plan for the species.

A biological evaluation must be prepared for all projects occurring on lands administered by the USDA Forest Service to assess the potential impacts to all PETS species and their habitats. If Townsends big-eared bat or suitable habitat exists within a proposed project, a field reconnaissance will be conducted under a sampling design sufficient to state that likely areas were searched at the proper time. The purpose of this document is to assist the district biologists in accomplishing this task.

CHAPTER II

SPECIES REVIEW

Description of Species. Plecotus townsendii is considered to be the most variable and "progressive" of the genus Plecotus (Handley, 1959). The bats are from 90-112 mm in total length, with the tail comprising 35-54 mm (Hall, 1981). The dorsal hair is bi-colored, the base being slate or gray, with the tips varying from pale yellow or cinnamon brown to dark brown (Kunz and Martin, 1982). The most prominent features are the large ears which may reach 39 mm in length and two fleshy glands which protrude from the end of the rostrum in a "horseshoe like" shape. The wings are broad and a relatively large propatagium (the wing membrane in front of the forearm) provide a great lifting capacity allowing a high maneuverability and hovering (Vaughn, 1970). Females were noted to be significantly larger than males by Williams and Findley (1979). The species is relatively gentle when handled but easily perishes when handled improperly. It is easily disturbed by human entry into its roost areas.

Status. Plecotus townsendii is a candidate species (category 2) for federal listing in Oregon, Washington, Idaho, and California. Two sub-species exist in Oregon and Washington. P. t. townsendii is proposed for endangered status and P. t. pallescens is proposed for threatened status. It is State listed as "Sensitive-Critical" for Oregon. It is also on the USDA Forest Service sensitive species lists for Regions 1, 5, and 6.

Natural History Review. P. townsendii is considered to be a bat which is dependent upon caves or cave like structures; e.g., mines, tunnels (Perkins and Levesque, 1987). Winter roosts provide a cool to cold roost (0-12 deg. C) site where these bats can enter torpor and spend the winter with body functions considerably slowed (Lyman, 1970). Winter roosts with large numbers (>10) of P. townsendii are usually characterized by discernible air flow resulting from multiple entrances (Perkins and Levesque, 1987). Roost sites of undisturbed bats are usually below the three meter height, if ceilings exceed that height. E. Pierson (pers. comm.) has found females are usually in clusters, while males roost singly.

Summer roosts vary by sex and in females with reproductive status (Tuttle, 1976). Most maternity colonies (females only) are in the warmer roosts (caves or mines), near the lighted entrance or at the edge of the dark zone. Most maternity colonies roost in a roughly circular group on vertical surfaces on the ceiling two to three meters off the floor. Females are constantly awake and are easily disturbed. They readily take flight, even with young attached if disturbance appears threatening. Males and nonparous females (without young) roost in cooler caves, attics, or mines (Tuttle, 1976). These bats usually day roost alone, allow body temperature to fall to ambient temperature, and arouse at night (Kunz, 1988).

Females appear to select more than one site for roosting after hibernating. One or more roost sites are "staging" sites close to the maternity roost site. Females gather here until just prior to parturition. They then move to the maternity roost where they will spend the rest of the summer unless disturbed (Perkins, 1992).

Reports from Dalton (1983), Schmidly (1991), Pearson, et al. (1952) and Adam (in litt.) do not mention this behavior, but most of their work does not include spring surveys or roost sites of clustering females. Nonparous females appear to disperse and roost singly, much in the same manner as the males.

This species is considered to be relatively sedentary (non migratory) with recorded movements usually less than 30 km (Humphrey and Kunz, 1976; Senger pers. comm.; and Wackenhut, 1990). Adam (1992) noted foraging range for females on the Daniel Boone National Forest is from 60.5 ha to 262.8 ha depending on the time of season. Baker and Patton (1967) has noted that the genetics of this species is very conservative. It is not known what the effect of sedentary behavior has on gene flow and diversity.

Primary insect prey appears to be moths (Ross, 1967; Whitaker, et al., 1977). Night roosts of this species are often littered with numerous moth wings. Individual species that serve as prey base have not yet been identified.

P. townsendii has wettable fur and thus avoids exposure to water as much as possible. Quiet water appear to be necessary as the bats extend the tongue and lap water as they fly over pools to avoid wetting even the muzzle area (J. S. Altenbach, pers. comm.). This observation poses the question of where water is obtained by P. townendii which roost near swiftly flowing waters along the Klamath and Snake Rivers.

One young is born per female per year, and survival to age two is estimated to be 50% (Kunz and Martin, 1982). Mark Perkins captured an individual in 1991 that was banded by J. Anderson in 1969 in a Bend, Oregon cave. The minimum age of the male was 21 years.

Distribution. In National Forests in Region 6, P. townsendii is found on both sides of the Cascade Range (Appendix A). Discussions in this document will be confined to those populations located on National Forests east of the Cascade crest as these populations appear to comprise a separate subspecies (P. t. pallescens). Table 1 shows the general area and estimated populations for those areas which have been at least marginally surveyed. Table 1 also shows those areas where a few (<10) have been noted and status is uncertain. Known distribution is biased toward suitable habitat (caves and mines). Most areas outside USFS lands in eastern Washington have not even been marginally surveyed. All data are from M. Perkins (field notes), S. Cross (field notes), Perkins and Levesque (1987) or Senger and Crawford (1984).

Known distribution on the Wallowa-Whitman National Forest is: 1. Hells Canyon (Maternity roost, one known hibernaculum and five day roost sites for single males); 2. one male was captured at the top of the canyon (Wallowa Valley Ranger District); 3. one individual was found at a mine (Pine RD); 4. Near Catherine Creek ; and 5. Near Elgin (adjacent to La Grande RD). This species is common in caves of the Fort Rock RD, Deschutes NF and has been documented from one cave (museum specimens-PSU) on the Sister's RD. The Bend RD has no confirmed records although the author noted one cave which had a significant amount of guano that could be assigned to P.

townsendii. At present, neither Mark Perkins nor Cross, et al. (1976) has noted this species from the Klamath or Winema National Forests. There is a museum record for P. townsendii which is adjacent to the Pendleton RD, Umatilla National Forest.

The largest known concentration of P. townsendii in eastern Washington is located on and adjacent to the Mt. Adams RD (Gifford Pinchot NF). Small population centers (>10) have been noted in mines in two ranger districts (Kettle Falls, Colville) of the Colville NF. A historic hibernaculum ( Naches RD) on the Wenatchee NF is still used by about 32 bats each year. No distributional records were found for the Okanogan NF.

Table 1. A summary of distribution, populations, and population trends of known and monitored P. townsendii in eastern Oregon and Washington. Population trends indicate change from 1983-1990.

| AREA | NUMBER OF SITES | POPULATION NUMBERS | POPULATION TRENDS |
|---|---|---|---|
| WASHINGTON | | | |
| Mt. Adams RD | 7 | 253 | +31% |
| Colville RD | 3 | 9 | ? |
| Kettle Falls RD | 1 | 8 | ? |
| Spokane BLM[1] | 2 | 9 | ? |
| Naches RD | 1 | 32 | ? |
| Spokane* | 1 | 1 | ? |
| Anatone* | 1 | 2 | ? |
| Orondo, WA* | ? | ? | ? |
| OREGON | | | |
| Fort Rock RD[2] | 7 | 352 | - |
| Officer's Cave | 1 | 185 | -50% |
| Service Creek | 1 | 30 | -40% |
| Saddle Butte | 7 | 343 | + 9% |
| Wallowa-Whitman NF[3] | 4 | 350 | ? |

* - Museum records, no ground confirmation of recent local populations.
? - Incomplete data, only one survey year and usually no maternity colony.
1 - Winter data only, no maternity colony known for these bats or the Colville NF bats.
2 - Apparently two separate populations, only one maternity colony known.
3 - Maternity and male roost known. Only known hibernaculum has about 8% of the estimated population. Major hibernaculum not yet discovered.

CHAPTER III

SURVEY PROTOCOL

Typical Habitats - Locating potential roost sites. There are several sources which can provide information on potential roosting habitat for P. townsendii. For locating caves or rockshelters, a local chapter of the National Speleological Society (four in Oregon and Washington) and archeological sources are often good sources. To locate mines, use BLM records and in Oregon the series of Oregon Metal Mines Handbooks. In addition, many USGS 7.5 min maps indicate fairly precise locations of mine tunnels. Each of these is a potential day or night roost site, summer and winter. Some building attics, in areas of caves or cavelike structures are also potential day roosts; abandoned basement or root cellars may provide hibernacula. Lists for each district should be compiled and checked off as surveys progress.

An existing inventory of surveyed sites can be gathered from various reports to various Federal and State agencies from Mark Perkins and Steve Cross. A comprehensive file of this information has not been documented. Approximately 1000 caves and mines have been inventoried in Oregon and Washington.

Survey timing. Each potential roost site should be surveyed for P. townsendii at least twice a year. Survey months are December-January for use as a hibernaculum, and mid-July to mid-August for use as a maternity colony or day roost. December and January surveys minimize disturbance because both sexes are in deep torpor and the reproductive activity is at a minimum. If weather is more mild than usual, entry into deep torpor by males and some females may be delayed. Bats may be active at hibernacula as late as the last week of November in years with warmer winters. Summer surveys are designed to locate maternity and male roost sites. In all cases, be certain to use recommended techniques to lessen disturbance and reduce the probability of abandonment of the roost site.

Survey Techniques. The following behavior is recommended for searching winter and summer roost sites: When approaching the cave or mine and during the search, avoid talking and other noise as much as possible. Recent research at Frio and James River Caves in Texas have revealed that noise at cave entrances can delay female outflights by Brasilian free-tailed bats as much as two hours (M. Tuttle, pers. comm.).

Recommended Winter survey techniques. The following guidelines are recommended for searching winter roost sites:

1. During winter searches use red lights (headlamps or flashlights with red lenses) if ceiling height or wall width does not cause safety problems. If you expect to encounter high ceilings or wide caves or mines, then use four or five cell Mag (R) lights which can be focused as a spot light or the beam spread and diffused in more confined areas.

2. Decide who is going where and who is counting which part of the cave or mine before entering. This will avoid duplicate counts

and talk inside the potential roost site. Use hand held "clicker" counters or mental tabulation. Below are various means of counting and recording data for analysis.

3. Identifying species other than P. townsendii may not be possible without handling individual bats. Determine before cave entry if disturbance is worth the knowledge and for which species.

4. Sometimes the bats are in clusters. If counting the cluster involves an approach where you might disturb one or all bats, consider estimating the area covered by the cluster by noting the diameter if circular, or length and width if rectangular. Then calculate area in square inches. Conservatively, each adult P. townsendii occupies about one square inch in clusters. This counting technique can also be used for nursery roosts. Comparisons indicate that calculated counts vary only two or three percent from actual counts.

Recommended Summer survey techniques. Summer surveys involve the following techniques which are used nationwide by experienced bat biologists when working with maternity roosts:

1. Approach the potential roost as quietly as possible and wait several minutes at the entrance to determine if you can hear the bats. Many times they are alert and socializing (particularly in the afternoon) and can be heard.

2. Enter the roost site on hands and knees. Use very weak white light or red light only. Bright light or upright humans will cause enough disturbance to make the bats take flight and possibly abandon the roost.

3. Move around the edges of the roost site, much like a large packrat, to observe the cluster and identify the species. If bats begin to fly, immediately abandon the search in the roost.

4. Alternatively, it is possible at some sites to count exiting bats. Position yourself (and others) at the entrance about 50 minutes before sunset and count exiting and entering bats for about 0.5 hour. Subtract entering bats from exiting bats and you should have a good estimation of roost numbers. **REMEMBER**, too much noise at the entrance may cause a delay in exiting bats and spoil any counting attempts. Hand clickers are useful in such counts.

Broad Band Bat Detectors.

Another method of surveying for P. townsendii involves the use of broad band bat detectors. Applications of this technique are in the "infancy" stage. For an informative review of bat detectors and their use, see Thomas and Laval (1988) and Fenton (1988). This method is relatively new and protocol for applications have not been defined. As the survey techniques develop, they will be published. Broad band detectors show good promise for the future and could replace other survey methods.

Survey Equipment. Survey equipment includes that necessary for caving and to record data. Following is a list of items, the necessity of which will vary with roost conditions:

Two (2) sources of light for each person
Hardhat with chinstrap
Harmful gas and oxygen deficiency detection devices
Knee pads
Compass
Red Light Filter
Sturdy but pliable gloves
Warm clothing (cave temperatures are from below freezing to about 60 deg. F)
Skid resistent boots
Data Sheets
Maps
First aid kit

Some specialized caves or mines may require vertical gear, $CO^2$ indicators, winches, etc. Safety is the first consideration. Always follow the Health and Safety Code Handbook section on cave surveys and administration (page 105-106). Some Myotis spp. bats may need to be captured for accurate identification. Scissor forceps or an open faced hand net may be used for capture. At that time, a field guide and a pair of calipers for forearm measurement becomes extremely useful.

Atypical Roost Sites. Attics, basements, root cellars, etc., should be surveyed in the same manner as caves and mines. In areas of more mild weather, it is possible that bats will use attics or cellars for hibernaculum. Other structures that may harbor bats in either season include but are not limited to: underneath bridges (as night or day roosts), abandoned train and car tunnels, abandoned irrigation tunnels and long cement culverts. To survey these structures for night roosts, begin about two hours after sunset and use mag lights and hand nets under bridges, bat traps or mist nest (constantly tended) at entrances to determine species and use.

A more general review of accepted bat practices may be found in Cross (1986), Kunz and Kurta (1988) and Thomas and LaVal (1988).

Forested Areas and Potential Foraging Areas. Since QMC mini-detectors (readily available commercial model) cannot discern P. townsendii, it is necessary to use broad band bat detectors and record calls. Only six of the 16 Pacific Northwest bat species can be positively identified by non-broad band detectors. None of the six species are of special concern to Region 6 at this time. Therefore, when surveying for P. townsendii, use broad band bat detectors.

Mist netting success for P. townsendii has been poor at best. Over water I have only captured this bat at three out of approximately 500 sites in Oregon and Washington. Steve Cross (pers. comm.) appears to have had similar results in his work.

No attempts have been made to net this species under the forest canopies or near clifflines as noted by Adams (1992).

CHAPTER IV -

**RESEARCH PROTOCOL**

The purpose of this chapter is to provide gudelines for conducting bat research which may reduce mortality and/or abandoment.

Experience and Technical Skills. Those who wish to undertake Plecotus research should have a strong background in wildlife or zoology with at least a mammalogy course. Any person collecting or handling any bat species in Oregon must have in possession a Scientific Taking Permit issued by the Oregon Department of Fish and Wildlife. A permit is not presently required for visual monitoring or survey work.

The value of extensive review of bat literature and field experience with those who have pioneered the study of P. townsendii cannot be ignored. Earlier research (1960-75) throughout the continental range of this species may have been one of the major impacts which led to the precipitous population declines. These activities included: indiscriminate collecting, banding of many individuals at hibernacula and nursery colonies, mist netting of entrances at critical habitat sites, and the use of unsupervised volunteers in the form of students and recreational cavers (Cross and Senger, pers. comm.). Since that era, we have documented that such activities lead to greatly diminished populations, abandonment of critical roost sites and relatively little scientific data.

Because this bat inhabits caves and mines, a degree of expertise is necessary to evaluate risk situations (mine safety) and expertise in caving practices, tools and safety. Accidents happen to even the best prepared. It is the training and preparedness which prevents most accidents from becoming fatalities. It is recommended that individuals get field experience from the National Speleological Society or an affiliate Grotto before attempting to survey caves or mines. In some cases, experience with vertical exposures may be necessary. This group is the national leader in cave exploration and safety methods.

Tools For Bat Work. The following are bat tools which are known to be effective, when properly applied, in Plecotus research. Those asterisked indicate that overuse or improper use may result in bat mortality or abandonment of the study roost. For a thorough discussion of applications see Kunz (1988) or Cross (1986).

"lipped" aluminum or plastic wing bands*
0.7 g radio transmitters* (with compatible receivers)
Mist nets*
Tuttle traps*
Remote sensing devices - for use in roosts or roost entrances:
    Hygrometers
    Infrared photography
    Light counters (those which count interruption of light beams)
    Traffic counters (to detect human disturbance)
Broad band recorders and decoders

Some additional tools are needed for temporary holding of the bats and/or data recording: calipers, soft cloth drawstring bags, scales, parasite collecting vials, tarps (for placement under day or night roosts for gathering of insect parts or guano), lights (usually the type that attach to caps or are on head bands to free up hands), data sheets, butterfly nets (for removal from night roosts or individual bats from day roosts), and a quality camera with macro lenses for photo documentation.

Use of narrow band bat detectors is not recommended as P. townsendii cannot be clearly keyed out with their use. Bat handlers should not wear gloves. The fragility of this bat species requires the researcher to be aware at all times of the pressure being placed on the held bat and its general reaction to the handling. It is impossible to accurately assess either of those concerns if the handler is wearing gloves. Perhaps the best "tool" is patience. Some research tasks will take more time to collect adequate data if one is to protect the integrity of the roost sites and avoid seasonal or permanent abandonment.

Impact on Local Populations. Research activities can depress, scatter or extirpate local populations of P. townsendii. Since most individuals do not move over 30 km (Wackenhut 1990; Humphrey and Kunz 1974; Perkins 1992; Senger pers. comm.), care should be taken to limit activities which involve direct contact with the bats. The following activities should be limited to not more than once per year: hibernacula surveys; entry into nursery roost sites; disturbance at male/single bat roost sites. These activities could be duplicated within a year if the reason is to restock remote sensing equipment. Restocking of equipment should be the only activity and instruments should be placed and entry timed to create the least disturbance. Exceptions to these guidelines will likely result in permanent or temporary abandonment of the roost site and possibly bat survival.

Where possible, individuals captured for marking or radio tagging should be obtained from transient or night roosts. Capture or removal of bats from the preferred day roost site may alienate the bats to that site for at least the current season. All bats at that site may abandon the roost if disturbance exceeds their threshold of tolerance. Tolerance thresholds differ for each colony, and may change seasonally within a colony. A conservative approach is the best way to accomplish research tasks without excess disturbance at day roost sites.

Exit counts at cave/mine entrances, use of broad band detectors and other "hands-off" techniques can be used throughout the summer with little or no impact on local populations if the above protocol is followed.

## CHAPTER V

The purpose of this chapter is to: identify different levels of expertise, discribe the need for a certification policy, and suppest minimum requirements for certification.

## LEVELS OF EXPERTISE

Level Classification. The objectives of research level classification are: 1) to ensure that those who work with this sensitive and easily disturbed species do not exacerbate the present human disturbance problem; 2) to limit senseless duplication of research efforts by providing a centralized organization to structure research activities and their time frames; 3) assure data gathering and end products provide worthwhile information that justifies the risk; and 4) provide a safeguard that will focus end products of research activity on bat conservation and population recovery.

To meet these objectives, it is suggested field activities be divided into three categories that would define an individual investigator's experience. Table 2 indicates activities which might fall under each level of competence. The certification levels and activities are not intended to be all inclusive, but a starting point for further refinement.

**LEVEL 1** - These field activities can be safely and successfully accomplished with literature review, familiarity with equipment, leadership from a Level 3 investigator, and perhaps a field trip to learn applicable techniques.

**LEVEL 2** - These activities require a moderate amount of hands on experience in the field with a fully trained bat researcher, ability to identify individual bats to species and sex, and cave safety training and experience.

**LEVEL 3** - These activities require experience gained at Level 2 and include competency in handling, radio tagging, banding (if necessary) and trapping at sensitive sites such as night roosts for nursery colonies, major hibernacula, etc.

Table 2. Suggested activities for each level of expertise regarding P. townsendii research.

| ACTIVITY | ASSISTANT MINIMUM LEVEL | LEADER MINIMUM LEVEL |
|---|---|---|
| Bat sonar detection | 1 | 1 |
| Exit counts | 1 | 1 |
| Remote Sensing (outside roost) | 1 | 1 |
| Radio tracking * | 1 | 3 |
| Mist netting (general) | 1 | 2 |
| Mist net Plecotus roosts | 1 | 3 |
| Hibernaculum survey | 1 | 2 |
| Maternity surveys | 1 | 3 |
| Night roost surveys (no nets) | 1 | 2 |
| Remote sensing (in hibernaculum) | 1 | 2 |
| Remote sensing (in maternity) | 1 | 3 |
| Radio attachment | 2 | 3 |
| Banding | 2 | 3 |

* Radio attachment to be done only by level 3. Tracking by level 1, 2, or 3.

Guidelines for Level Certification. Each level of certification involves interaction of the researcher with the bats. Interaction is very low and risk is very low for Level 1, while Level 3 activities involve the greatest interaction and risk to local bat populations. We have attempted to divide levels such that certification at each level requires individuals to be not only more experienced, but also have an understanding of research objectives vs. risks involved.

Most individuals could easily obtain a Level 1 certification. This initial proposal presents standards that would allow progression from Level 1 to Level 3 with about two years field experience, dependent upon available field work. However, several factors outside of just "bat handling" experience should be considered: 1) individuals education and/or experience level; 2) ability to define a research question and outline probable techniques to acquire adequate data for a quantifiable answer and fall within the conservation/recovery objective of species; 3) ability to conduct research activities within established guidelines and direct Level 1 or 2 assistants without undue risk to the study population; and 4) ability to complete research in a timely manner without undue risk to local populations. In addition, the number of individuals certified will most likely exhibit the "pyramid" effect with most certifications at Level 1, fewer at Level 2 and the least at Level 3. Table 3 outlines suggested minimum requirements for certification.

Table 3. Suggested minimum requirements for level certification for use in P. townsendii research protocol. Workers should also be able to identify bats to species.

| REQUIREMENT | LEVEL 1 | LEVEL 2 | LEVEL 3 |
|---|---|---|---|
| Mammalogy | X | X | X |
| Bat Class [1] | X | X | X |
| P. townsendii class [1] | X | X | X |
| Equipment familiarity [2] | X | X | X |
| Exit count experience [4] | X | X | X |
| Night roost experience [4] | X | X | X |
| Remote Sensing (outside roost) [2] | X | X | X |
| Hibernaculum survey experience [5] | | X | X |
| Maternity roost survey experience [5] | | X | X |
| Banding [3] | | | X |
| Radio Tagging [3,6] | | | X |
| Light Tracking [3] | | | X |
| Remote Sensing (in Hibernaculum) [5] | | X | X |
| Remote sensing (in maternity) [3] | | | X |

1. Available from OR Chapt Wildlife Society, Aug. 1992 and in Spring, 1993.
2. Requires familiarity with equipment, data sheets and research objectives.
3. Requires at least one, possibly two full seasons for handling techniques, equipment familiarity and research goals.
4. Can be acquired within one or two trips with a certified individual.
5. Requires one seasons work and protocol familiarity with Level 3 present.
6. Attachment of chemluminescent light globes to bats ventral area for visual tracking.

Certifying Agency. Perhaps the most obvious choice for this task would be the non-game division of the Oregon Department of Fish and Wildlife, and the Washington Department of Wildlife. These agencies presently issue permits to research, collect, etc., for public and private individuals. While the bat remains a federal candidate species, the State has the authority for such issuances. Should P. townsendii be federally listed as threatened or endangered, then certification and permit issuance would likely belong to the United States Fish and Wildlife Service. A certification policy complete with training opportunities that was satisfactory to both State and federal agencies needs to be established. Development of such a policy is considered outside the scope of this document.

We recommend Region 6, in conjunction with the two State wildlife departments, provide certification and training through a unified cooperative effort, with the States taking the lead role. For certification to be effective, there needs to be ample training opportunities to get people qualified for various levels. Some flexibility in requirements will be necessary.

CHAPTER VI

INTERIM GUIDE TO SPECIES CONSERVATION

The objectives of this section are to provide: 1) actions that will protect and increase depleted populations at roost and nursery sites; 2) guidelines to protect and enhance foraging habitat; 3) suggestions of interim actions to protect potential roost sites and foraging habitat; and 4) guidelines that will avoid the need for federal listing as endangered or threatened.

Human Disturbance. The main objective here is to limit human interaction with bats at their preferred roost sites. There are several ways to accomplish this and some are listed below. This list begins with the lowest level of management and grades to the most intense level of management.

1. Limit knowledge of and directions to all roost and nursery sites both within a public agency and to the public.

2. Restrict public visitation to roost site by seasonal closure. Signs could be posted giving dates of closure and access dates.

3. Limit surveys and monitoring by qualified individuals to no more than once yearly.

4. Limit research activities to qualified individuals.

5. When excessive human contact or visitation becomes a problem, entrance gates and patrolling seem to be the only way to enforce seasonal closures.

6. Use seasonal or permanent road closures to limit access to sensitive sites.

Pesticides. P. townsendii is a moth strategist. It is highly probable adult Tussock and Spruce Budworm moths comprise a portion of its diet. To battle Tussock moth and Spruce Budworm, the preferred means of recent years is aerial spraying of B. T. (Bacillus thuringiensis). B. T. is a biological insecticide that is fairly selective on Tussock moth and Spruce Budworm when used during their larvae stage of development. Since P.townsendii preys primarily on flying moths, B.T. should not directly effect this bat. However, it may effect the bat by reducing its prey base. B.T. may suppress enough moth reproduction to suppress one or two years reproduction of the bats.

Cumulative effects of B. T. on all bat species are not known. A conservative approach would be to limit use of B. T. in the area where this bat is known to occur, and leave a buffer zone greater than 640 acres (Adams, pers. comm.).

Forest Activities-Hard Rock Mining. The development of mine shafts is the reason that we have several available roosts within National Forests. Return of hard rock or "gouge" mining at old hard rock (adit) claims may extirpate any bats using those sites. Surveys of active claims and a careful review of yearly plans to coordinate mining activity with bat uses are needed. There

are no textbook answers for bats/mines, and usually each case has unique aspects that should be considered individually. The goals should be to maintain a viable roost for the bats (undisturbed) and allow non-destructive mining activity to take place. Bats which presently are using mines may have took up residence when a natural roost site was destroyed or altered. In many cases, if mines entrances are closed, the bats have no alternate roost sites left. Abandoned mines are important roost sites throughout the Pacific Northwest, particularly where dams, logging or recreation have extirpated bats from natural roosts.

Some abandoned mine sites can be rehabilitated and encourage use by P. townsendii and other species. Entrance shoring, ventilation (provide air flow, an important component of hibernacula) and lack of human disturbance will all assist in attracting bats to mines.

Forest Activities-Recreation. Spelunkers who belong to organizations usually have high conservation values, and are aware of avoiding bat roost sites. Education of the general public is a must if roost sites are to be protected without the expense of gating every site to prevent disturbance. Professional recreationist guides could be potential allies, if incorporation of what is done with the bat sites (particularly those which are well known) is added to their public presentations. This gives guides an added incentive to preserve the resource as it becomes commercially exploitable in a non-consumptive manner. We recommend: not making roost sites public knowledge, directing recreation away from roost sites, and the signing/gating/ system when necessary.

Forest Activities-Bridges. When planning new bridges or bridge replacements, data indicates two bridge types are preferable: 1) build with concrete I-beams; the beams form heat sinks for bats and other vertebrates to use for roost and nursery areas; and 2) bridges which appear to be flat bottomed, but have a hollow interior for routing of underground utilities. Most of these bridges have a round "man-hole" entry in the bottom. The bats use these "cave-like structures" for nurseries.

Forest Activities-Logging. Logging activities are known to extirpate locally roosting bats during the work activities. Activities near known day roosts, night roosts, and hibernacula should be seasonally timed to avoid these sites when bats are present.

Reports from Steve Gellman of the Pacific SW Research Station (pers. comm.) indicate that many different bat species are using hollow redwood trees for day roosts, night roosts and maternity colonies. Gellman's research of bat use of hollow trees began this June. Initial reports indicate M. thysanodes use redwoods for maternity roosts. Several P. townsendii have been found night roosting under bridges in the redwood forests. The apparent day roost sites are hollow redwoods. There exists a high potential that P. townsendii could use hollows in tree species present in eastside Forests of Region 6. Leaving snags and heart rot (hollow) living trees will provide potential roost sites for P. townsendii and other bats species. Where this bat is known to occur, we recommend maintaining at least the 60% snag level within 640 acres surrounding the site.

## CHAPTER VII

## INTERIM DATA NEEDS

Searches for roosting P. townsendii have been conducted on many of the eastside Forests. The only district which has had all known caves or mines surveyed (as of 1990) is the Fort Rock Ranger District. This completeness is an artifact of the popularity of the District as an area for recreational caving.

Surveys. A catalogue which contains data regarding, but not limited to: potential roost sites (caves, mines, abandoned buildings, etc.), date, time and results of past surveys, sites to be surveyed, management activities (proposed and active), and long range population goals should be assembled for each forest with copies of district data available to each district. Unsurveyed sites should then be surveyed by qualified individuals within the next fiscal year. Sites which harbor P. townsendii or other bat species should have a specific management plan to minimize or avoid impacts. The initial survey(s) will likely miss potential roost sites. These should be catalogued as they are noted and surveys conducted on a regular basis.

Known roost sites should be monitored annually or biannually for population shifts or abandonment. Negative population shifts or seasonal abandonment probably indicates disturbance. Conservation management guidelines should be applied.

Movements and Seasonal Roosts. At several locations in eastside forests, either nurseries or hibernacula sites, but not both are known (Table 4). An application of more intensive surveys would provide this information.

It is uncertain where most males roost in summer, where females roost between the time they leave the hibernaculum and arrive at the nursery, and where females roost between abandonment of nurseries and arrival at the hibernaculum. Characters of interseasonal roosts, duration of use, importance and what percentage of the population uses each one is unknown. Knowledge of roost site locations and characteristics would assist in protecting the population and in its recovery.

Potential mechanisms for determining these sites include but are not limited to radio telemetry, light tagging, and field surveys.

Foraging. Although the literature agrees that this bat is primarily a moth strategist, little is known of foraging needs. Some data that would be helpful: female forage range, male forage range, are moths gleaned or aerially captured or both. Also, in many instances, watering sites are not confirmed. This bat may occur in desert-like areas of the Great Basin, but it does need daily intake of water to survive.

Knowledge of home ranges for males and females will assist in roost site management. The data will relate to season of use, roost loyalty, sizes of buffer zones, the necessary prey base, and if buffer zones will be adequate for an increased population base.

Roost Site Replacement. Kunz and Martin (1982), E. Pierson (pers. comm.) and S. Cross (pers. comm.) indicate that P. townsendii uses some attic sites for maternity and single male day roosts. It is likely that artificial structures such as bat boxes could be designed to accommodate this species to provide adequate day roost sites. A more complete knowledge of characteristics of natural or mine roost sites would assist in the design of any such structure. Present knowledge includes roost height, light levels, and temperature. Effects of humidity, exposure direction and surrounding vegetation are among those characters not yet quantified.

## CHAPTER VII

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**APPENDIX A -**

**REGION 6 EASTSIDE DISTRIBUTION**

Some sites are not on the Forests proper, but adjacent to or near enough to USFS lands for consideration. This list is abbreviated and is not intended to imply that any Forest has been thoroughly surveyed for this bat species. The opposite is usually the case. Sites are not pinpointed in order to help protect the species.

**OREGON**

Mt. Hood National Forest - 8 miles south, 8 miles west of the Dalles.

Deschutes National Forest - Mushroom Cave, Lower QM Cave, Lava River Cave, Charlie the Cave, Skeleton Cave, Lee's Cave, Boyd Cave, Twin Skylight Cave, Bat Cave, Wind Cave.

Winema National Forest - Not recorded on this Forest.

Fremont National Forest - Not recorded on this Forest.

Ochoco National Forest - Not recorded on this Forest.

John Day National Forest - Not recorded on this Forest.

Umatilla National Forest - 15 miles east of Milton-Freewater.

Wallowa-Whitman National Forest - Mtn. Chief Mine, Temperance Creek, Electrolyte Mine, Big Bar, Daddy Lode Mines, Buckhorn C.G., Downy Saddle, Granite Creek, Elgin, 6 miles north of Elgin, Elgin Ice Caves, Catherine Creek Ice Caves.

**WASHINGTON**

Gifford-Pinchot National Forest - COG Cave, Ice Rink Cave, Peterson Prairie Caves, Backbone Cave, New Cave, Deadhorse Cave, Goose Cave, Dot Cave.

Wenatchee National Forest - Boulder Cave.

Okanogan National Forest - Not recorded on this Forest.

Colville National Forest - Mine north of Kettle Falls.